STUDY OF A
LOW PROFILE SCHOOL:

RIVERHEIGHTS SCHOOL
BRANDON, MANITOBA

Prepared in co-operation with
Brandon School Division #40
by the Research Branch
Manitoba Department of Education

Hon. Keith A. Cosens, Minister

MANITOBA
DEPARTMENT OF EDUCATION

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I. INTRODUCTION

Background

In March 1976, the Brandon School Division decided to build a new school, (Kindergarten to Grade 9), to accommodate children in the Riverheights Subdivision in Brandon, Manitoba. Although the initial design considered by the Board was for a conventional school, additional factors and trends caused the Board to re-examine their decision. After study and analysis, the Board opted for a "low profile" school.

The purposes of this report are: to examine the events and processes that led the Brandon School Board to build a school that is partially covered by earth; to discuss the construction and operational considerations involved in this decision; and, to describe the structural features and design of the school as it exists today.

Definitions

The following terms are used throughout this paper as defined below.

Low Profile — A conventional school building has its main floor at or above ground level. In contrast, a low profile structure has its main floor **lower** than ground level, thus reducing the height of the total structure.

Earthberm — This refers to the use of earth to cover a building structure for purposes such as insulation.

Reasons for the School's Design

Events preceding the decision to construct the school had a direct effect on the School Board's decision to employ alternate construction techniques. Over the preceding five year period, the Board had witnessed an increase of 253% in heating costs. The Board envisioned that substantial increases would continue into the foreseeable future and, therefore, it was desirable to minimize the effects of these cost increases on the new building. Also, during the period 1973 to 1976, insurance costs rose by 280%, while the deductible increased from $25.00 to $5,000.00. Much of this increased insurance premium and deductible was attributed to the rising costs of vandalism.

The School Board had the opportunity to enter into an arrangement with the City of Brandon to develop the site for the school, with adjacent property to be used jointly as a recreational area. Concerns had been raised about the effects of a large building on a neighborhood comprising single family homes. Thus, the opportunity to integrate the building into the park setting was attractive.

The Board chose to deal with these concerns by specifying to their architect, Mr. Don McFeetors of Macdonald, Cockburn, McFeetors, that the school's design should be governed by the following parameters:

1) "the design for the school must create the most conducive learning and teaching environment possible while meeting the educational needs of the Brandon School Division; and,

2) the design must respect and respond to the critical environment problems which could adversely affect the school and the community."

The Board, together with their architect, set out to research and plan for a school that would satisfy these parameters.

II. PLANNING

In searching for a design that would meet the parameters, the concept of a "low profile" school surfaced. This concept provided for earth to cover about 75% of the building's shell. The earth layer would provide an insulating factor. There is less temperature variation at a depth of eight to ten feet, where the average temperature is 45°F and varies about 10° from summer to winter. Thus, both heating and cooling would be more economical in this design than in a conventional building. Also, the earth covering would reduce the area accessible to vandalism. In addition, this type of design would be complementary to the setting and would provide more green space than a conventionally designed school.

The Board, although interested in the low profile concept, was conscious of the need to assess the potential reaction of students, parents, and teachers to such a concept. An investigation was launched.

A thorough review of available literature was undertaken. The first earth covered school was opened in September, 1962, in Artesia, New Mexico, U.S.A. Research conducted by Dr. Frank W. Lutz, Professor of Education at Pennsylvania State University, concluded that "there seems to be a slight positive effect of structure type affecting the general physcial and mental health of pupils attending the earth covered structure."[1] Further, the data collected by medical staff serving the community supported his conclusion that the earth covered structure had no ill effects on the physical or mental health of students.

In order to obtain first hand information, School Division representaties, an architect, a structural engineer, and a mechanical engineer toured Hoover Elementary School, Freemont School and Wilson School (Anaheim, California) in October, 1976. During this process, parents, students and teachers were interviewed. The delegation returned to Brandon, satisfied that the low profile design of the schools was not detrimental to the health or achievement of students. This information was shared with parents and the Brandon newsmedia.

A meeting of parents in the Riverheights area was called on January 6, 1977. They were informed of the plans for a low profile school. A model of the proposed school, as well as slides of schools visited in California, were presented

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[1]Source: Frank W. Lutz, "Studies of Children in an Underground School," a paper presented at the Conference on Alternatives in Energy Conservation: The Use of Earth Covered Buildings, held by the Center for Energy Policy Studies, the University of Texas at Arlington, July 1975.

to the parents. Given the implications of this design for energy conservation, reduction of vandalism, and site utilization, the parents gave the plan their full support.

III. CONSTRUCTION

Construction of the subterranean poured concrete structure began in February of 1978. However, a strike, from May to September of the same year, interrupted construction. As a result, Riverheights School was not completed until September, 1979.

The school was constructed within the same cost parameters as comparable conventional schools. Moreover, Riverheights School was designed for low maintenance and for passive energy conservation. The low profile design took into account these factors, as well as considerations such as site costs and the potential for recreational facilities.

Building Structures

The reality of increasing energy costs makes the "earthberm" concept attractive. The earthcover provides natural insulation all year round, while snowcover increases the protection during winter months. Air infiltration is minimized because of the gradual slope of the earth-covered concrete structure. In addition, the walls and roof have three to five inches of conventional insulation. This system of insulation eliminates some of the heat loss which normally occurs through walls and windows.

One advantage in using earth as an insulator is the temperature lag. For example, in January the subterranean sections of the soil still hold an October temperature. Conversely, during the summer the earth retains a cooler temperature. This moderating effect helps to reduce both heating and cooling costs. The

School Division, in co-operation with the National Research Council, is monitoring the actual amount of heat lost through earthberm walls. This project concludes in September 1981.

Other energy conserving features include: double doorways, quadruple glazing of windows; time clocks on car plugs and on the air change system; reduced hot water temperature; and, reduced lighting which utilizes sodium and mercury vapour lamps where possible. The gymnasium roof is reinforced to support the future addition of solar panels, while the earth "berms" would accommodate the necessary storage tanks. Staff and students have developed energy conservation units, designed to help lower energy costs and to increase student awareness.

The design of the school is also intended to reduce vandalism. The earth cover reduces the exposed building surface by 75%, while the remaining 25% consists mainly of durable material, such as brick, concrete and aluminum. Inside, one section of the school can be isolated to facilitate community use outside of regular school hours, thus protecting the remainder of the school from vandalism.

The reduction in exposed exterior building surface also results in lower maintenance costs. The earth cover and the inverted roof system protect the roof membrane from "thermal shock." Re-roofing should occur less often than is usual in areas which experience extreme temperature fluctuations.

Site costs were another consideration in the design and construction of the school. The increasing cost of land means that any spacesaving design is of benefit. Limited site space can accommodate a low profile. In fact, an area of 1.1 acres on the roof was reclaimed for greenspace and recreation.

The potential for recreation facilities with the City of Brandon allows for joint use of the land as a park, school and play area. The school being built into the natural slope of a hill results in easy integration into a park setting. However, development of the park remains in the planning stages.

Special Features

A number of special features had to be incorporated into the design because of the use of "earthberm" construction. Substantial waterproofing was necessary on exterior walls and the roof. The inverted roof system allowed for retention of a constant temperature which decreases deterioration of waterproofing.

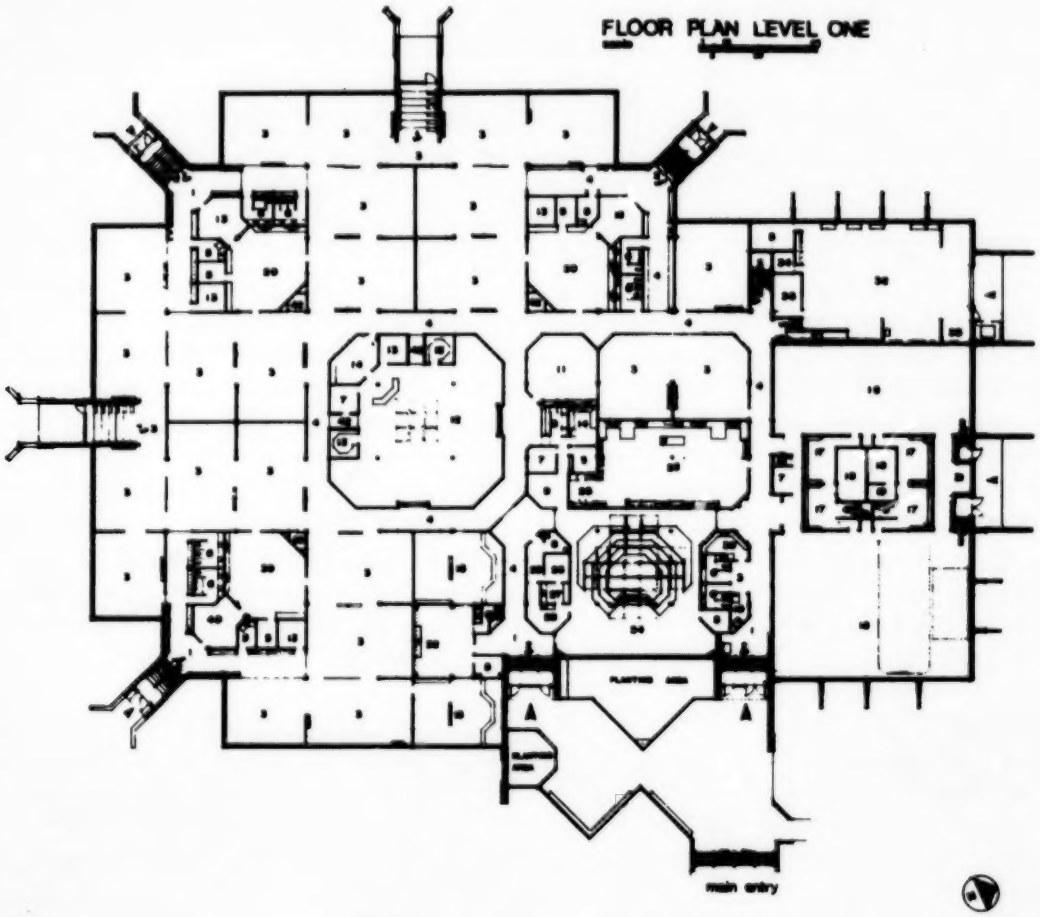
Ironically, natural light is an important component in the "earthberm" concept. A large skylight in the centre of the resource area diffuses natural light in the heart of the school. Windows and doors around its perimeter also allow for the introduction of natural light. Landscaping is of importance to the "earthberm" concept. Not only is it necessary in an aesthetic sense, but also it protects the earthcover from the effects of erosion.

Although some of these features caused increased construction costs, the school's total cost was within the usual cost parameters for school buildings. For example, less exterior finishing and glazing was required. The design facilitates future savings in the areas of energy, maintenance and vandalism. Finally, it should be noted that the functions of the school were not sacrificed to enhance the low profile ideas. The completed school represents a pleasing educational environment for its students.

IV. RIVERHEIGHTS SCHOOL TODAY

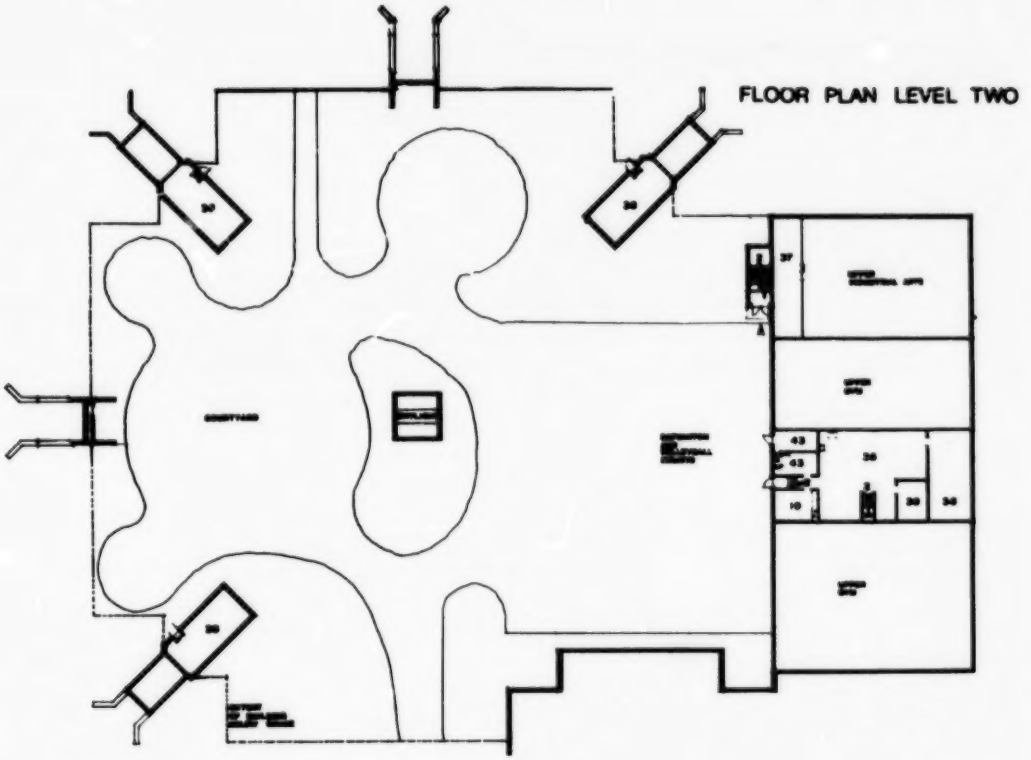
School Population

In September of 1981, 551 students were enrolled in grades Kindergarten through Nine at Riverheights School. At full capacity, the building can accommodate up to 725 students, which might become necessary if the school population of the new subdivision increases.



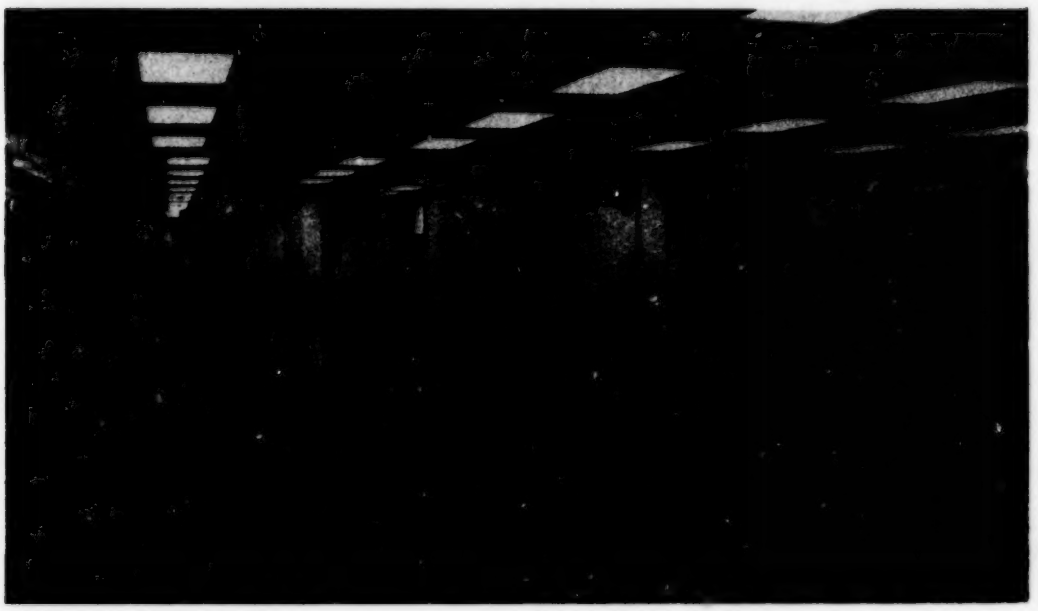
LEGEND

1 Foyer
2 Stair
3 Classroom
4 Corridor
5 Storage
6 Lavatory
7 Office
8 Secretary
9 Principal
10 Janitor
11 Staff
12 Material Resource Centre
13 Seminar
14 Work
15 Kindergarten
16 Gymnasium
17 Change Room
18 Shower
19 Drying Room
20 Science
21 Science/Seminar
22 Wet Area
23 Home Economics
24 Music
25 Fitting
26 Medical
27 Infirmary
28 Dental
29 Waiting
30 Canteen
31 Equipment
32 Industrial Arts
33 Supply Room
34 Flatsh
35 Planning
36 Mechanical
37 Stock Room
38 Electrical
39 Special Education Classroom
40 Special Education Seminar
41 Ramp
42 Display
43 Exterior Storage



Floor Plan

The floor plan of Riverheights School was designed to accommodate a wide range of grade levels. At first glance, it may seem to be in many respects, a traditional floor plan. Upon closer examination, however, several unusual and innovative features are revealed. These include a series of classroom modules, a central resource centre, a self-contained administrative and recreational module, as well as other unique characteristics.



i) **Classroom Modules.** Classroom areas are separated into primary, elementary and junior high groupings, which range from semi-open to closed classrooms. In addition, two large Kindergarten rooms, (1,000 sq. ft. each), provide a series of teaching spaces of various sizes and flexibility. Each module has its own entry system, coat areas, washrooms and science centre.

ii) **Resource Centre.** At the physical center of the school, highlighted by the large central skylight, is the material resource centre. The open, airy feeling of the room is accentuated by a variety of large hanging plants and by the storage of print materials in low-level bookcases. Work areas for small groups of students are available, but of most interest are several small rooms, or "dens", off the resource centre. These "dens" can be used as tutorial, reading or mini-conference rooms.

iii) **Administrative/Recreational Module.** The fourth module in the school contains the administrative suite and the technical instruction classrooms, as well as the recreational and entertainment areas. The most significant feature of this module is the ease with which it can be made available to the community after hours, while the rest of the school remains locked up.

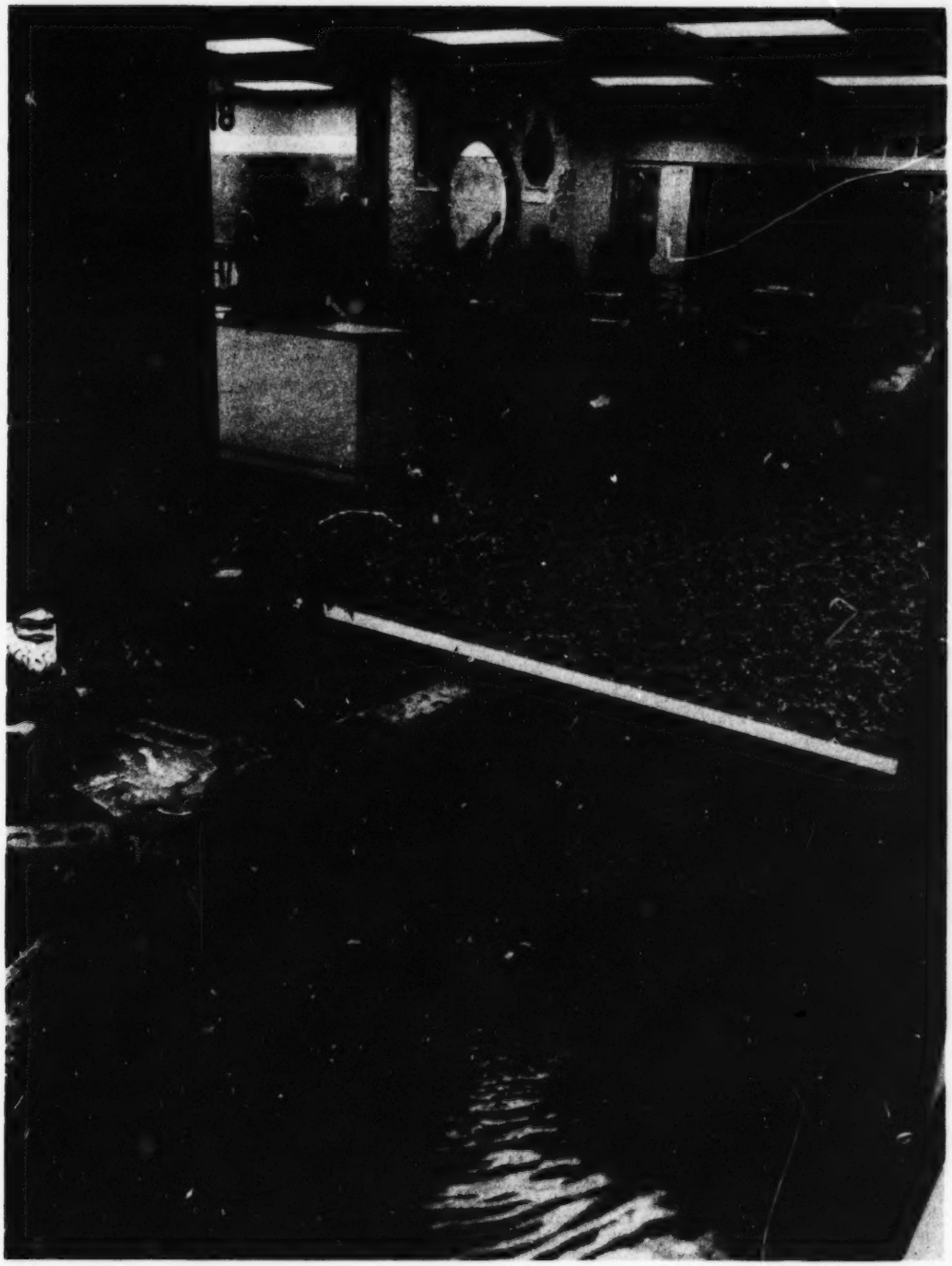
The location of Riverheight's administrative suite is somewhat unusual in a school building. Although directly accessible from the school's main entry, it is adjacent to the resource centre at the heart of the school. The secretarial desk is open to the corridor overlooking the resource centre; thus, the secretary can also assist with library services. The principal's office, staff room, medical rooms and canteen are contained in this section as well.

The home economics room, (1,600 sq. ft.), and industrial arts area, (2,800 sq. ft.), are well-equipped for technical instruction.

Riverheights School boasts two gymnasiums: the major gym has 3,500 sq. ft. and the minor gym has 2,100 sq. ft. of playing area. Showers and change areas are situated between the two gymnasiums. The wide range of grade levels in this school makes the separate and smaller recreational facilities very practical, especially from a safety viewpoint.

The extra-large area in the music room, (2,187 sq. ft.), was designed to provide open "theatre-like" facilities for the school. Space for a band or choir, instrument storage, music library and practice rooms is available.

iv) **Unique Characteristics.** Other features of the floor plan at Riverheights School include science display units and extra wide corridors which result from the open-pod design. The wide corridors not only permit smooth flow of traffic, but also add to the "open" feeling of the school. An interesting feature of the floor plan, discovered by the students, is the small theatre-like space created at the junction of the entry-ways and the corridor. Several wide steps provide levels for students to sit and look down into the corridor, where a variety of activities can be staged.



Another unique feature of this school are the three display areas in each level's module of classrooms. Students contribute to and tend the mini-environments created within these glassed walls. It is not unusual to see small reptiles, in a setting of water, rocks, and plant life, enclosed in one of these display areas.

HAPPY
HOLIDAYS

V. SUMMARY

In 1976 the Brandon School Division intended to construct a new above-ground school in the Riverheights Subdivision. However, after carefully assessing a wide variety of factors, the original design was modified to become a low profile structure. At that time it was also concluded that the costs of this innovation would be well within appropriate limits. Consequently, Riverheights School was constructed.

The subsequent success of the Riverheights design can be attributed to careful assessment of both the school's intended functions and the rising costs facing the School Division. Moreover, involving School Board members, school and division staff, as well as community members, in the planning of the school, helped to insure the acceptance of the low profile structure. A full year of successful operation has justified this initial acceptance.

August, 1981